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EDUCATIONAL FACTORS EXPLAINING 9TH GRADERS SELF-EFFICACY IN ECOLOGICAL SUSTAINABLE BEHAVIOURS

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Abstract: This study aims to provide new information on the contribution of Education for sustainable development (ESD) on grade nine students' self-efficacy beliefs concerning their own ability and competence to contribute to sustainable development. Self-efficacy is a construct that theorists impute an important role upon as causation for action. A nationally representative sample of 2361 Finnish 9th graders from 49 schools were, together with their subjects teachers (n=442) and headmasters (n=49) surveyed on issues relating to education for sustainable development, school culture and teaching approaches. A combination of exploratory and confirmatory factor analyses was used to test construct validity of the instrument. Multilevel regression models were used to explain differences in students' self-efficacy beliefs concerning sustainable development. Results show that individual level variables (biocentric values, interest in sustainable development, knowledge about environmental issues, and experiences with sustainability at school) explained most of the variation in students' self-efficacy. Furthermore, the results show that if schools score high on school culture indicators for implementation of sustainable development, and for internal cooperation and cooperation with external bodies, their students will show a higher self-efficacy. Finally, the results also show that teachers can directly increase their students' self-efficacy through inquiry-based and interactive teaching methods. These results illustrate that teaching approaches and school culture can enhance students' self-efficacy beliefs in ecological sustainable behaviours, and thus that schools can be effective actors in sustainable development.

Keywords: ESD, self-efficacy, 9th graders, school culture, multilevel regression analysis

INTRODUCTION

According to the basic report of Brundtland in 1987, the general aim of sustainable development is to direct human activities so that it is possible to satisfy the needs of the present generations without compromising the ability of future generations to satisfy theirs. Because ecological, social, cultural and economic sustainability dimensions have to interact constructively, sustainable development is a challenge for all people, organizations and societies. Achieving a sustainable future requires aware, critical and active citizens, who are ready to meet multifaceted problems and conflicts, co-operate and able to combine theoretical knowledge with practical innovations and ideas. Education for sustainable development (ESD) is a crucial instrument in achieving these goals (Breiting, Mayer & Mogensen, 2005).

A central issue in the debate on the effectiveness of ESD is the ultimate outcome of ESD-efforts. Many scholars agree that behavioural choices at the individual level are among the important outcomes of ESD, and much effort has gone into explaining why different individuals behave differently. Elaborate theoretical models have been built to predict one's sustainable behaviour and in recent year attention has turned to the behaviour of the decision

makers of the future: students in secondary education. A central concept in behavioural literature, that has not yet got the attention it deserves within research on ESD, is that of self-efficacy. Bandura (1997) describes self-efficacy a person's belief in his/her ability to succeed in a particular situation. In the model of environmentally responsible citizenship, often used in the studies of environmental education, the empowerment, the belief of one's abilities to act for the environment, has been regarded to be an important variable to predict pro-environmental behaviour (Hungerford & Volk, 1990).

For ESD, a self-efficacy could be defined to be a personal belief of one's ability to act sustainable way in her/his own life, such as commit ecological and economic sustainable behaviours, for instance sustainable consumption and energy use or acting for environmental preservation in one's own organization. More human-centred behaviours of sustainability skills are abilities to act for social and cultural sustainability, such as being aware and accepting social fairness and equality, and acting for the fulfilment of these goals in one's own life and as a member of an organization, such as a student in the secondary school. One important learning goal for the students is to understand the complex relations between different sustainability dimensions and have willingness and abilities critically and constructively discuss and present suggestions for challenging economic, ecological and social problems, locally and globally.

The self-efficacy of Finnish 9th graders, regarding their ecological sustainable behaviour is the central issue of the current paper. In this study we will focus on what explains differences in students' self-efficacy. Many studies in the domain of environmental education and education for sustainable development have focused on the individual as the primary level of measurement. Individuals, however, operate within social structure; they are part of a social context. People are born into, and grow up in a cultural setting, that provides experiences and shapes the attitudes and behaviours (Giddens, 1997; Boeve-de Pauw & Van Petegem, 2010). Instead of just considering the individual in it, a better level of measurement would therefore be the individual within its context. In this paper we move away from the individualistic approach and place 9th grade students within the context of their school. At the school level, specific attention goes to the contribution elements of teaching approaches to ESD and of the schools' action culture have to students' self-efficacy.

Personal and school level variables are likely to influence students' self-efficacy beliefs on their readiness to take sustainability in to account in their own life. In general, values, attitudes and norms are important predictors of any eco-sustainability behaviours (Milfont & Duckitt, 2010). In the studies of environmental values, biocentric and utilistic nature value are often considered. Biocentric nature value refers to willingness to the preservation and utilistic nature value to the tough utilization of natural resources (c.f Bogner & Wiseman, 2006). School education provides students learning experiences which encourage them to ponder sustainability values, knowledge and skills, the modes of which are written to the conscious or unconscious curriculum of the school. To find out the relative role of sustainability school education in influencing students' self-efficacy beliefs regarding students personal factors, which in turn are affected also by many out-of-school influences, it is important to study the relative role on individual and school level factors simultaneously.

ESD has holistic goals, many of which are value-laden. The goals of ESD have been included into the school curricula of countries word-wide. The effectiveness of sustainability education, however, has been poorly researched and weakly evidenced (Tilbury, 2011). One important aspect in ESD research is to identify and analyse the evolving contribution of ESD in the educational community. To act for a sustainable future, ESD is in key position. However, there is no such thing as 'the' correct interpretation of or approach to ESD.

According to UNESCO, ESD should deal with environmental, societal, cultural and economic issues both from a local and a global viewpoint. Pedagogically, the evolving nature of the concept of sustainability and participatory learning, and higher-order thinking skills are emphasized. The nature of ESD is interdisciplinary and formal, non-formal and informal learning environments are used to build ecological, social, cultural and economic sustainability skills for students to make informed decisions and to act for a sustainable future. ESD requires a whole-school approach, including students', teachers', principals', and other school staff's co-operation within and outside the school (Henderson & Tillbury, 2004).

The success and learning of any organization is based on the action culture, values and norms which the organization follows. School culture can be defined to be formed of the basic assumptions, norms and values, cultural artefacts and practices that are shared by school members (Schein, 1985; Maslowski, 2001). According to them, the cultural elements of a school can be described as three different levels depending on their visibility within the school and their consciousness among the school staff. On the first level, teachers' basic assumptions deal for instance with the nature of reality, human being and human activity. Basic assumptions are taken for granted, they are invisible and preconscious. On the second level there are values, norms are beliefs on what is good, right or desirable, and the teachers are more aware of these beliefs than on the basic assumptions. For instance, teachers may agree that teaching on recycling is important part of ESD at school activities. The third level consists of artefacts and practices, reflecting the way how the basic assumptions, values and norms turn up in the school culture. For instance the myths and symbols that are often presented in the school are cultural artefacts that reflect assumptions, values and norms, and they serve as role models for the teachers. In schools, the practices are behavioural patterns reflecting the underlying more or less conscious cultural elements. As for ESD, for instance Green Flag may present a sustainability artefact and ecologically responsible behaviour the practice that reflects schools commitment to sustainability.

The whole-school approach to sustainability is a forward-looking task, and it requires the cooperation within the students, teachers and other staff groups, as well as cooperation with actors outside the school (Henderson & Tillbury, 2004). School culture may promote for instance cross-curricular themes, use of different learning environments and the internal and external cooperation emphasized for instance in the national curriculum of basic education. The whole-school requires the cooperation within the school pupils, teachers and other staff groups, as well as cooperation with actors outside the school (Henderson & Tillbury, 2004). Understanding school culture is related to the process of change and headmasters' role as an important person in this process (Flores, 2004).

Rationale and purpose

During the last decade, research on ESD based on large surveys has gradually increased. To be able to study and compare the level of sustainability culture in the school, the development of ESD indicators are in essential role (Tillbury, 2007). For instance as a part of international ENSI network, Breiting, Mayer & Mogensen (2005) developed quality criteria for ESD schools. Their criteria falls into three different areas: Quality criteria regarding the quality of teaching and learning processes, the school policy and organisation and the school's external relations, each of which are divided to smaller areas. The same kind of criteria can be found also for Green Flag schools and the curricula of schools emphasizing ESD in general. To integrate principles of sustainable development into the school's teaching and education as well as daily activities, it is necessary to assess the existing school culture and change it if needed. Understanding school culture is related to the process of change as well as headmasters and teachers role in this process. The aim of this study is to find out what are the

key factors for effective ESD at school with regards to stimulating students' self-efficacy. The central research question for the current study is:

What is the contribution of students' individual level and schools' level variables in students' self-efficacy beliefs concerning ecological sustainability behaviours?

At the *individual* level we try to explain, what is the role of students' (a) school experiences with eco-sustainability, (b) interest in SD, (c) knowledge about SD, and (d) nature values on their self-efficacy beliefs to act ecological sustainable way. At the *school level* the aim is to explain the importance of (a) school's sustainability action culture as reported by headmasters ESD actions and (b) teaching approaches by subject teachers.

METHOD

Students, teachers and headmasters

To study factors behind secondary school students' sustainability actions at secondary schools, a large scale research project was initiated in Finland in 2009. Students' personal factors and school experiences, teachers' sustainability actions as well as school culture managed by headmasters' were studied in a large-scale survey. Three different types of questionnaires to survey the factors behind primary and secondary students', teachers' and headmasters' sustainable actions were used (see for instance Uitto & Saloranta, 2010; Uitto & Saloranta, 2012). A stratified sampling method was used when collecting the nationally representative data in 2010. Altogether 49 schools returned questionnaires so that the response rate for headmasters was 91 %, for subject teachers' 60 %, and for students 73%. The questionnaires contained sections to elicit responses from headmasters and teachers on items concerning management, implementation, and teaching of ESD at school. For students, independent variables such as nature values, interest in ecological sustainability issues were measured. Self-efficacy beliefs were tapped through items such as: *What do you think about your skills to act in sustainable way? Choose the alternative you think best suits your opinion. I can by my own actions diminish my consumption of electrical energy (5 = excellently, 4 = rather good, 3 = middling, 2 = rather poorly, 1 = very poorly).*

Subject teachers' questionnaire contained sections to elicit responses from teachers on items concerning actions and teaching on ecological, economic, social and cultural sustainability at school. They were asked for instance how often they used to carry out 'whole-school approach' actions, such as saving energy or materials at school, or considered different aspects of sustainability in their teaching. The commonness of different activities was rated on a five-point Likert-type scale: 5 = *very often*, 4 = *rather often*, 3 = *sometimes*, 2 = *rather seldom*, 1 = *very seldom*. An exploratory factor analysis was used to identify the latent variables of the activities and teaching. Several factors that represent teachers' own sustainability actions at school's everyday live and the consideration of different sustainability dimensions in their teaching could be discerned. A more detailed description on the methods and results are presented by Uitto and Saloranta (2012).

Headmasters were asked about how ESD was realized in their school's culture. They were asked questions concerning leadership and management of ESD and how ESD was implemented during last three years at their schools. The background of these questions lies on international definition of ESD schools and especially Finnish scheme on "Sustainable development certification of educational establishments" (Laininen, Manninen & Tenhunen, 2006; Breiting, Mayer & Mogensen, 2005). Headmasters answered *yes* or *no* to the

statements concerning leadership and management situation at their school. They were asked for instance school's ESD program and action plan and how responsibilities of ESD work was organised. The prevalence of implementing ESD themes at school was scored five-point Likert-scale: 5 = *very often*, 4 = *rather often*, 3 = *sometimes*, 2 = *rather seldom*, 1 = *very seldom*. The implementing items include 12 different themes of ESD for instance recycling and waste prevention, transports and traffic and cultural environment and traditions. All dimensions of SD were involved.

In the current study, the students' self-efficacy was the dependent variable. Other student factors were included as explanatory variables at the individual level. The teachers' and principals' factors were and included as aggregated explanatory variables at school level.

Analytical approach

Multilevel regression analyses were used to figure out the importance of individual and school level variables in students' self-efficacy beliefs in ecological sustainability behaviours. The analyses were performed in several steps. Based on item configurations that were obtained through a combination of exploratory and confirmatory factor analyses in a previous study, factor scores were calculated and standardized. To study teachers and headmasters role in the multilevel analysis, school means for the variable items scores were calculated. Effects of independent variables on the dependent variable were assessed through hierarchical linear models (HLM). We performed the analysis in several steps, starting with the estimation of a zero model, which estimated the amount of variation in student self-efficacy at both levels (the individual and the school).

The zero model allowed us to estimate the Intraclass Correlation Coefficient (ICC), which gives the proportion of the total variance that exists among groups. Next, the independent variables were systematically included in several consecutive models. First, a model with all individual level variables was estimated. We specifically opted for the random intercept model since our main focus is not on comparing the effect of the explanatory variables between individual schools, but across all schools in the sample. Then, the individual level variables were supplemented with the school-level variables. Again, we opted for the random intercept model. We report the deviance of each model, which indicates how well the model fits the data, and the number of estimated parameters (degrees of freedom). The use of the maximum likelihood estimation method, allows us to use the deviances to test whether a more advanced model fits significantly better to the data than a previous model that is nested within the more advanced model (Hox, 2002). PASW was used to perform the exploratory factor analyses and to estimate the multilevel regression models. The *Mplus* software package was used to perform the confirmatory factor analyses.

RESULTS

In the present study we focus on the results of the HML analysis. In the previous studies of Uitto and Saloranta (2010, 2012) result on the students, sustainability-related personal factors, such as values, attitudes, interests and school experiences are reported. The results of the HLM analyses are presented in the Table 1. The table includes only the zero model and the final model of the analysis. Furthermore, only variables which had a significant effect (expressed as β in the table) on the students' self-efficacy are reported. At the individual level, the results show that girls have higher self-efficacy beliefs than boys. Also, having experiences in the wide domain of ESD seems to have a positive impact in students' self-efficacy. The results show that interest on and knowledge of ecological issues increase self-

efficacy. The largest effect is observed for biocentric values: student who score 1 standard deviation higher on biocentrism, score 0.33 higher on self-efficacy.

Table 1

Effects (β) of individual and school level variables on 9th grade students' self-efficacy belief regarding ecological sustainable behaviour

	<i>Zero model</i>	<i>Final model</i>
<i>Intercept</i>	0.000	-0.05
<i>Individual level variables</i>		
Gender (reference is girls)		0.077*
Sustainability experiences at school		0.216*
Interest in ecological issues		0.190*
Biocentric nature value		0.329*
Knowledge of ecological issues		0.108*
<i>School level variables</i>		
ESD teaching through inquiry		0.091*
ESD teaching through interactive methods		0.053*
School culture - Management : ESD program		0.054*
School culture - Management : cooperation		0.052*
School culture - Management : organization		0.094*
School culture - Implementation: Ecological ESD		0.106*
School culture - Implementation : Social ESD		0.059*
<i>Random</i>		
Variance at individual level	0.955*	0.589*
Variance at school level	0.045*	0.000
R ² individual level		0.38
R ² school level		1.00
Deviance	6648.69	4816.752*
Degrees of freedom	3	19

Note. * $p < .05$

As the focus of the current study is on the educational factors included into the model at school level, we do not go into detail on the individual level effects. Further research into their interconnectedness could include structural equation modelling. It is important, however, to note that by including the individual level variables, they are corrected for at the level of the school. School level effects are thus not due to uncontrolled for differences in students' individual variables between the schools in the sample.

At school level, the HLM revealed that several of the included variables had significant effects on students' self-efficacy. As for the teacher variables, inquiry-based teaching and interactive methods had both positive impacts on students' self-efficacy beliefs in ecological behaviours. This is an important finding since it shows, that choices made by the teachers on their in class practice can contribute to ESD. The headmaster indicators of ESD that reflect management practices regarding the SD program, the internal and external cooperation and the organization of ESD, and the implementation of ecological and social aspects of SD in the school daily functioning impact positively on student self-efficacy. Overall, the model explains about 38% of the variance between individual students and all of the observed variance between schools.

DISCUSSION AND CONCLUSION

In this study we constructed a multilevel regression model that explains the contribution of both individual and school level variables on 9th graders self-efficacy beliefs in ecological sustainable behaviours. In general, individual level factors are most important in explaining students' self-efficacy beliefs in ecological sustainability behaviours in different schools. This is in accordance with a previous study of Uitto et al. (2011) who found that differences within the 75 Finnish schools were much larger than differences between the schools in ninth grade students' biocentric nature value, attitudes towards environmental issues and interest in environmental issues. In that study the school explained 3-4 % of the total variance in different variables. This may indicate that students' out-of- school experiences, such as parental influence and personal interest have strong influence on students' environmental values, knowledge on and interest in ecological sustainability. Similar patterns on the schools differences were also found in studies on the effectiveness of eco-schools in Flanders (Boeve-de Pauw & Van Petegem, 2011).

Subject teachers' contribution on the development of students' self-efficacy was evident as the teaching approaches and working methods they used. As suggested for sustainability education (Henderson & Tillbury, 2004), inquiry-based and co-operative working methods were related to student self-efficacy beliefs. Schools in which teachers teach ESD through inquiry and/or through interactive methods have students with a higher self-efficacy. These results suggest that teacher can impact on their students' future behavioural choices relating to sustainable development. The results are in line with those of Coertjens, Boeve-de Pauw, De Maeyer and Van Petegem (2010) who used the nationally representative data of PISA2006 to illustrate the impact teacher can have, through their teaching methods, on their students' environmentalism. However, there are likely to be more variability between different teacher groups, because in their study Uitto and Saloranta (2012) found that subject as such explained more about the variation of subject teacher connections to sustainability actions, than for instance the gender of the teacher. There were large differences for instance between the teachers in science, arts and crafts. Similar differences between the teachers were found also in a Swedish study (Borg, Gericke, Höglund & Bergman, 2013).

Although school level variables explained much less than personal factors on students self-efficacy beliefs on ecological sustainability behaviours, schools role cannot be neglected. The results showed that it is important for ESD that the school have made conscious decisions on sustainability education, which indicate that school has adopted the values, norms and practices of sustainability education in their actions. According to Schein (1985) and Maslowski (2001), this implies that the culture of those schools, which have invested in ESD, may have changed its basic assumptions, norms and values, cultural artefacts and practices that are shared by school member in such a way that it has an influence to students' self-

efficacy. In this case the school have made cultural decisions on their values, norms are beliefs on what is good, right or desirable, and they direct their goals and practices accordingly. The efforts, especially organizing ESD activities at school, co-operating within the school and implementing ecological and social sustainability activities for the students to experience will increase the students' self-efficacy to act ecological sustainable way. As the results show, the headmasters' perceptions of certain distinct aspects of the school's action culture relating to ESD have important effects of the students' self-efficacy. Cooperation within and outside the school, participating in a formal ESD program and implementing both environmental and social practices on ESD into the school's functioning all increase the students' self-efficacy. As stated by (Flores, 2004), for the development of school culture the role of headmaster is important.

In conclusion, the results suggest that the variables included into the model are important indicators of successful ESD in schools: both the school culture, as perceived by the headmaster, and the in class practice of teacher matter, when it comes to boosting ninth grader students' self-efficacy in ecological sustainability behaviour.

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